

09/936,692

2

In the claims:

1. (Currently Amended) An ionomer composite composition having improved physical properties, the composite consisting essentially of:

a glass material containing at least one of divalent cations and multivalent cations; and

at least one substantially hydrophobic copolymer, comprising:

at least one hydrophilic monomer containing acid functional groups adapted to react with the at least one of divalent cations and multivalent cations to form ionic crosslinks among polymer chains, the hydrophilic monomer present in an amount sufficient to impart a desired degree of aqueous solubility to the copolymer; and

at least one hydrophobic monomer present in an amount sufficient to impart a desired degree of structural stability to the composite composition when exposed to an aqueous environment;

~~wherein the at least one hydrophilic monomer and the at least one hydrophobic monomer are present in a predetermined ratio of hydrophilic monomer to hydrophobic monomer, wherein the higher the amount of hydrophilic monomer in the ratio the more water soluble the composition, and the higher the amount of hydrophobic monomer in the ratio the more water insoluble the composition.~~

2. (Previously Amended) The ionomer composite composition as defined in claim 1 wherein the glass material further contains fluoride, and wherein the composite composition provides fluoride release.

3. (Original) The ionomer composite composition as defined in claim 1 wherein the glass material is selected from the group consisting of SiO_2 , Al_2O_3 , AlF_3 , CaF_2 , NaF , Na_3AlF_6 , AlPO_4 , and mixtures thereof.

4. (Original) The ionomer composite composition as defined in claim 1 wherein a weight ratio of glass material to copolymer ranges between about 10:90 and about 90:10.

09/936,692

3

5. (Original) The ionomer composite composition as defined in claim 4 wherein the weight ratio of glass material to copolymer ranges between about 40:60 and about 85:15.

6. (Original) The ionomer composite composition as defined in claim 1 wherein the at least one hydrophilic monomer is a monomer containing unsaturated carboxylic acid.

7. (Currently Amended) The ionomer composite composition as defined in claim 6 wherein the unsaturated carboxylic acid is selected from the group consisting of: acrylic acid, methacrylic acid, 4-vinylbenzoic acid, crotonic acid, oleic acid, elaidic acid, itaconic acid, maleic acid, fumaric acid, acetylenedicarboxylic acid, tricarbollylic acid, sorbic acid, linoleic acid, linolenic acid, eicosapentenoic acid, anhydrides of the acids, ~~hydrophilic derivatives of the unsaturated carboxylic acids,~~ and mixtures thereof.

8. (Currently Amended) The ionomer composite composition as defined in claim 7 wherein the hydrophilic monomer is selected from the group consisting of organic acids having at least one of sulfonic acid and phosphonic acid replacement of the carboxyl group of the unsaturated carboxylic acids, ~~hydrophilic derivatives of the organic acids,~~ and mixtures thereof.

9. (Original) The ionomer composite composition as defined in claim 1 wherein the at least one hydrophobic monomer is unsaturated.

10. (Currently Amended) The ionomer composite composition as defined in claim 9 wherein the at least one hydrophobic monomer is selected from the group consisting of acrylates, methacrylates, ethylenes, propylenes, tetra-fluoroethylene, styrenes, vinyl chloride, vinylidene chloride, vinyl acetate, acrylonitrile, 2,2-bis[4-(2-hydroxy-3-methacryloyloxy-propyloxy)-phenyl] propane (Bis-GMA), ethyleneglycol dimethacrylate (EGDMA), tri-ethyleneglycol dimethacrylate (TEGDMA), bis(2-methacryly-oxyethyl) ester of isophthalic acid (MBI), bis(2-meth-acrylyoxyethyl) ester of terephthalic acid (MET), bis(2-methacrylyoxyethyl) ester of phthalic acid (MEP), 2,2-bis(4-methacrylyoxy phenyl) propane

09/936,692

4

(BisMA), 2,2-bis[4-(2-methacryloxyethoxy) phenyl] propane (BisEMA), 2,2-bis[4-(3-methacryloxy-propoxy) phenyl] propane (BisPMA), hexafluoro-1,5-pentanediol dimethacrylate (HFPDMA), bis-(2-methacryloxyethoxy-hexafluoro-2-propyl) benzene [Bis(MEHFP) ϕ], 1,6-bis(methacryloxy-2-ethoxycarbonylamino)-2,4,4-tri-methylhexan (UEDMA), spiro orthocarbonates, ~~hydrophobic derivatives of the hydrophobic monomers~~, and mixtures thereof.

11. (Currently Amended) The ionomer composite composition as defined in claim 1 wherein a ratio of the hydrophilic monomer to the hydrophobic monomer is between about 1:99 and about 99:1 25:75.

12. (Previously Amended) The ionomer composite composition as defined in claim 1 wherein the at least one copolymer is selected from the group consisting of poly(methyl methacrylate-methacrylic acid), poly(methyl acrylate-acrylic acid), poly(methyl methacrylate-acrylic acid), poly(ethyl acrylate-acrylic acid), poly(ethyl methacrylate-methacrylic acid), poly(butyl acrylate-acrylic acid), poly(ethylene-acrylic acid), poly(ethylene-methacrylic acid), poly(acrylonitrile-maleic anhydride), poly(butadiene-acrylonitrile-acrylic acid), poly(butadiene-maleic acid), poly(butadiene-maleic anhydride), poly(propylene-acrylic acid), poly(propylene-ethylene-acrylic acid), poly(vinyl chloride-vinyl acetate-maleic acid), and mixtures thereof.

13. (Original) The ionomer composite composition as defined in claim 1 wherein the composite further includes as a minor constituent a polymer selected from the group consisting of PMMA, polycarbonates, polyethylenes, polyamides, PEEK polymers, epoxies, and mixtures thereof.

14. (Original) The ionomer composite composition as defined in claim 2 wherein the composite further includes a minor constituent selected from the group consisting of pigments, surfactants, adhesion enhancers, fluoride releasing enhancers, bioactive agents, and mixtures thereof.

09/936,692

5

15. (Original) The ionomer composite composition as defined in claim 2 wherein the glass material consists of 25.10 wt% SiO₂, 37.45 wt% Al₂O₃, and 37.45 wt% CaF₂.

16. (Original) The ionomer composite composition as defined in claim 1 wherein the at least one copolymer is poly(methyl methacrylate-co-methacrylic acid) (PMMA-MAA).

17. (Original) The ionomer composite composition as defined in claim 16 wherein the ratio of PMMA to MAA is 80:20.

18. (Currently Amended) An ionomer composite composition having improved physical properties and useful for dental applications, the composite consisting essentially of:
a glass material containing at least one of divalent cations and multivalent cations; and

at least one substantially hydrophobic copolymer, comprising:

at least one hydrophilic monomer containing acid functional groups adapted to react with the at least one of divalent cations and multivalent cations to form ionic crosslinks among polymer chains, the hydrophilic monomer present in an amount sufficient to impart a desired degree of aqueous solubility to the copolymer, the hydrophilic monomer amount ranging between about 1% and about 25% of the copolymer; and

at least one hydrophobic monomer present in an amount sufficient to impart a desired degree of structural stability to the composite composition when exposed to an aqueous environment, the hydrophobic monomer amount ranging between about 75% and about 99% of the copolymer;

~~wherein the at least one hydrophilic monomer and the at least one hydrophobic monomer are present in a predetermined ratio of hydrophilic monomer to hydrophobic monomer, wherein the higher the amount of hydrophilic monomer in the ratio, the more water soluble the composite composition, and the higher the amount of hydrophobic monomer in the ratio, the more water insoluble the composite composition; and~~

09/936,692

6

wherein the composite composition is adaptable for use in dental applications ranging from those requiring ~~water soluble compositions, to~~ partially soluble compositions; to those requiring water insoluble compositions.

19. (Previously Amended) The ionomer composite composition as defined in claim 18 wherein the glass material further contains fluoride, and wherein the composite composition provides fluoride release.

20. (Original) The ionomer composite composition as defined in claim 19 wherein the glass material is selected from the group consisting of SiO_2 , Al_2O_3 , AlF_3 , CaF_2 , NaF , Na_3AlF_6 , AlPO_4 , and mixtures thereof.

21. (Original) The ionomer composite composition as defined in claim 20 wherein the weight ratio of glass material to copolymer ranges between about 40:60 and about 85:15.

22. (Currently Amended) The ionomer composite composition as defined in claim 21 wherein the at least one hydrophilic monomer is an unsaturated carboxylic acid selected from the group consisting of: acrylic acid, methacrylic acid, 4-vinylbenzoic acid, crotonic acid, oleic acid, elaidic acid, itaconic acid, maleic acid, fumaric acid, acetylenedicarboxylic acid, tricarbollic acid, sorbic acid, linoleic acid, linolenic acid, eicosapentenoic acid, anhydrides of the acids, ~~hydrophilic derivatives of the unsaturated carboxylic acids,~~ and mixtures thereof.

23. (Currently Amended) The ionomer composite composition as defined in claim 22 wherein the at least one hydrophilic monomer is selected from the group consisting of organic acids having at least one of sulfonic acid and phosphonic acid replacement of the carboxyl group of the unsaturated carboxylic acids, ~~hydrophilic derivatives of the organic acids,~~ and mixtures thereof.

24. (Previously Amended) The ionomer composite composition as defined in claim 22 wherein the at least one hydrophobic monomer is unsaturated and is selected from the group

09/936,692

7

consisting of acrylates, methacrylates, ethylenes, propylenes, tetra-fluoroethylene, styrenes, vinyl chloride, vinylidene chloride, vinyl acetate, acrylonitrile, 2,2-bis[4-(2-hydroxy-3-methacryloyloxy-propyloxy)-phenyl] propane (Bis-GMA), ethyleneglycol dimethacrylate (EGDMA), tri-ethyleneglycol dimethacrylate (TEGDMA), bis(2-methacryly-oxyethyl) ester of isophthalic acid (MEI), bis(2-meth-acrylyoxyethyl) ester of terephthalic acid (MET), bis(2-methacrylyoxyethyl) ester of phthalic acid (MEP), 2,2-bis(4-methacryloxy phenyl) propane (BisMA), 2,2-bis[4-(2-methacrylyloxyethoxy) phenyl] propane (BisEMA), 2,2-bis[4-(3-methacrylyloxy-propoxy) phenyl] propane (BisPMA), hexafluoro-1,5-pentanediol dimethacrylate (HFPDMA), bis-(2-methacrylyloxyethoxy-hexafluoro-2-propyl) benzene [Bis(MEHFP) ϕ], 1,6-bis(methacrylyloxy-2-ethoxycarbonylamino)-2,4,4-tri-methylhexan (UEDMA), spiro orthocarbonates, ~~hydrophobic derivatives of the hydrophobic monomers~~, and mixtures thereof.

25. (Currently Amended) The ionomer composite composition as defined in claim 24 wherein a ratio of the hydrophilic monomer to the hydrophobic monomer is between about 1:99 5:95 and about 99:1 20:80.

26. (Previously Amended) The ionomer composite composition as defined in claim 18 wherein the at least one copolymer is selected from the group consisting of poly(methyl methacrylate-methacrylic acid), poly(methyl acrylate-acrylic acid), poly(methyl methacrylate-acrylic acid), poly(ethyl acrylate-acrylic acid), poly(ethyl methacrylate-methacrylic acid), poly(butyl acrylate-acrylic acid), poly(ethylene-acrylic acid), poly(ethylene-methacrylic acid), poly(acrylonitrile-maleic anhydride), poly(butadiene-acrylonitrile-acrylic acid), poly(butadiene-maleic acid), poly(butadiene-maleic anhydride), poly(propylene-acrylic acid), poly(propylene-ethylene-acrylic acid), poly(vinyl chloride-vinyl acetate-maleic acid), and mixtures thereof.

09/936,692

8

27. (Original) The ionomer composite composition as defined in claim 18 wherein the composite further includes as a minor constituent a polymer selected from the group consisting of PMMA, polycarbonates, polyethylenes, polyamides, PEEK polymers, epoxies, and mixtures thereof.

28. (Original) The ionomer composite composition as defined in claim 19 wherein the composite further includes a minor constituent selected from the group consisting of pigments, surfactants, adhesion enhancers, fluoride releasing enhancers, bioactive agents, and mixtures thereof.

29. (Original) The ionomer composite composition as defined in claim 19 wherein the glass material consists of 25.10 wt% SiO_2 , 37.45 wt% Al_2O_3 , and 37.45 wt% CaF_2 .

30. (Original) The ionomer composite composition as defined in claim 19 wherein the at least one copolymer is poly(methyl methacrylate-co-methacrylic acid) (PMMA-MAA).

31. (Original) The ionomer composite composition as defined in claim 30 wherein the ratio of PMMA to MAA is 80:20.

Please cancel Claims 32-49 without prejudice.